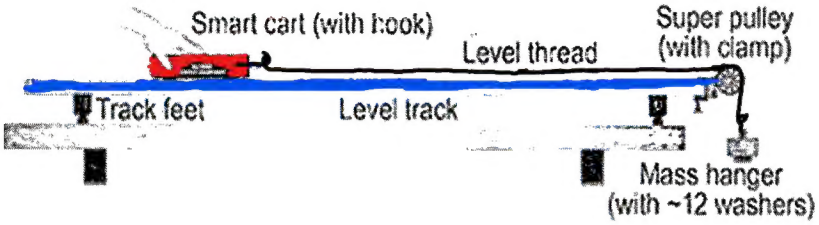
Work - Energy Theorem

What happens to the kinetic energy of the cart as it is pulled by a constant force? Energy when introduced into a closed system will either increase the kinetic energy, potential energy, or both. When the object in question receives a force over a distance and the object does not increase or decrease its height relative to the gravitational field, its new energy will go toward increasing the object's kinetic energy. This increase of kinetic energy will most often be seen with an increase in speed. Today we will see if the relationship stated below can be substantiated.



$$F \cdot d = \Delta \text{ K.E.} = \text{K.E.}_f - \text{K. E.}_i$$

$$\text{K. E.} = \tfrac{1}{2}\, m\, v^2$$

Materials: Obtain a ramp, smart cart, smart pulley, washers, smart pulley clamp, and one string about 1.5 m long.

Procedure: set up the materials as shown in the picture. Have the string attached to the cart and have the hanger attached to the end of the string. Draw back the cart on the ramp and stop once the hanger is very close to the smart pulley.

Turn on your Chromebook and start your SparkVue program. Set up two graphs on the SparkVue window. One graph is position vs. time and the second graph is velocity vs. time.

Place two (2) washers onto the hanger. Hold the cart in position so the hanger is just below the hanger. Start the SparkVue program and release the cart. Stop the cart and insure that it does not hit the pulley. Repeat the process again.

Next add two more washers to the hanger and repeat the original procedure. Repeat the process a second time.

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Finally, add two more washers onto the hanger for a total of six (6) washers. Repeat the original procedure twice.

Record the weights of the hanger and washers in the chart provided.

Mass of cart = 0.2485 kg
TI washer =

Mass of Cart and hanging mass (trial 1) = .300 kg .

Mass of Cart and hanging mass (trial 2) = .334 kg .

Mass of Cart and hanging mass (trial 3) = .369 kg .

Find, from the velocity graph, the final speed of the cart for trial one, trial two, and trial three.

Final speed of the smart cart (trial 1) = 1.6 m/s

Final speed of the smart cart (trial 2) = 1.8 m/s

Final speed of the smart cart (trial 3) = 2.0 m/s

$\frac{1}{2}mv^2$

1) Does the work done equal the ΔKE? Yes .

2) Make a graph of Force vs. distance for trial one. Find the area under the curve for the Force vs. distance graph. How does the area under the curve compared with the ΔKE. Area under curve = 0.459 J. It is 0.075 Joules more than ΔKE.

Trials	Force	distance	Work done	KE_i	KE_f	Δ KE
1	0.515	0.8916	0.459	0	0.384	0.384
2	0.855	0.7032	0.601	0	0.541	0.541
3	1.205	0.6135	0.739	0	0.738	0.738

1.6 x .3